Avera McKennan Trauma Service
Trauma Pitfalls – Case Studies

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CEN, CCRN
Clinical Nurse Educator
Objectives

- Identify pitfalls associated with caring for the trauma patient.
- Review the multidisciplinary course of care for the injured patient.
- Review appropriate treatments utilized when caring for the trauma patient.
The Why?

Every year, 199,800 people die from injuries and violence in the U.S.

For every person that dies:
- 13 are hospitalized
- 135 are treated in an emergency room

More than 33,700 people died in motor vehicle crashes.

2.5 million hospitalizations
26.9 million ED visits

Total cost from injuries and violence:
- $671 billion in 2013 medical & work loss costs

2,791,000 older people treated in emergency rooms for fall injuries each year.
What is Trauma??

What do you consider trauma at your facility??

physical injury. synonyms: injury, damage, wound; cut, laceration, lesion, abrasion, contusion "the trauma to the liver"
Definition of a **Trauma Team Alert** patient:
*South Dakota Trauma System*

**Physiological Absolutes:**

Adult:
- GCS < 10
- BP < 90
- Pulse > 120
- Respirations < 10 or > 29, or airway obstruction or respiratory compromise requiring use of advanced airway

Child:
- The Pediatric Assessment Triangle should be the basis for all pediatric emergencies

**Anatomic Absolutes:**
- Penetrating injury to chest, abdomen, head, neck
- Limb Paralysis (associated with Trauma)
- Flail Chest
- Amputation proximal to wrist or ankle

**Strong degree of suspicion** should be used for the following patients, but this does not constitute an automatic categorization of a severe trauma patient:
- Pelvic Fractures
- Falls from 2 times the height of the patient
- Patients involved in high energy MVA’s
- Death of an occupant in the same compartment
- Auto-Pedestrian or Auto-Bicycle with impact of greater than 5 MPH
- Pedestrian that was thrown or run-over
- Significant recreational vehicle or farm equipment incident
- Significant injury associated with a large animal

The following **co-morbidities** should also offer a high degree of suspicion:
- Age < 5 or > 55
- Pregnancy
- Chronic medical illness
Case Study #1: MCC
MCC

- ~ 1800: 57 y/o male (driver) & 50 y/o female (passenger) motorcycle vs. pick-up @ 50 mph
  - Not wearing protective leathers
  - Not wearing a helmet
  - Significant lower extremity trauma & bleeding – tourniquets placed per by-standers
  - EMS activated @ 1803
MCC
1812: ALS EMS @ scene

- Male (1814)
  - Uncontrolled bleeding from leg – bone sticking out of leg
  - Awake, drowsy – answers questions
  - C-spine held manually per bystander
  - Belt applied as tourniquet
  - Skin clammy, cap refill < 2 seconds

- Female (1814)
  - Uncontrolled bleeding from leg – bone sticking out of leg
  - Awake – answers questions
  - C-spine held manually per bystander
  - Belt applied as tourniquet
  - Skin clammy, cap refill < 2 seconds
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*South Dakota Trauma System*

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| Pulse > 120             | **The following co-morbidities** should also offer a high degree of suspicion: |
| Respiration < 10 or > 29, or airway obstruction or respiratory compromise requiring use of advanced airway | - Age < 5 or > 55  
                          | - Pregnancy  
                          | - Chronic medical illness  |

Child:
The Pediatric Assessment Triangle should be the basis for all pediatric emergencies

- Mass casualty?
- Does this criteria change when you are expecting 2 patients?
MCC: EMS – Male pt.

- 1814: EMS assessment (EBL 1-2 liters)
- 1815: Long board & c-collar, leg straightened
- 1820: GCS 14 – 75/50 – 136 - 25
- 1821: O2 via non-rebreather
- 1825: En route to hospital. Report called – trauma activation
- 1827: Commercial tourniquet applied
Tourniquets

- **Goal**: To control life-threatening vascular hemorrhage from extremity wounds.

- Use when bleeding **cannot** be controlled with direct pressure, there are multiple wounds or you’re in need of free hands.

- May be left on until definitive extremity stability is performed. The longer the application, the higher risk of complication (ischemia, reperfusion injury, compartment syndrome, pain).
Tourniquets
Tourniquets

When Every Second Counts

Despite the proven effectiveness of the Combat Application Tourniquet®, the new C•A•T® GEN7 goes even further toward making it easier and faster to use. All six components of the Combat Application Tourniquet® have been re-designed and improved on the C•A•T® GEN7.

1. Single Routing Buckle
   Decreased blood loss, effective slack removal, fewer windlass turns, simplified training with single protocol application standards

2. Windlass Rod
   Increased diameter, enhanced strength, aggressive ribbing improves grip

3. Windlass Clip
   Bilateral beveled entry, rapid windlass lock, bilateral buttress, added strength

4. Windlass Strap
   New reinforced strap, gray color for tactical considerations (Black only)

5. Stabilization Plate
   Reinforced, beveled contact bar, improved comfort

6. Free-Moving Internal Band
   Patented band within band, truly even distribution of circumferential pressure
MCC: Referring Facility

- 1815: Careflight dispatched
- 1836: Arrives @ facility
  - GCS 13 – bleeding controlled w/tourniquet
    - neck crepitus – mangled lower extremity
- 1843: IV bilateral hands & IO R)Shoulder – NS bolus x 2 liters
- 1846: Prep for RSI (HR 122 – BP 161/133)
- 1850: Pt intubated (121 – 155/133)
RSI: Rapid Sequence Intubation

- Emergency airway management technique resulting in rapid unconsciousness through the use of a sedation agent immediately followed by paralysis through the use of neuromuscular blockade.
  1. Preparation (position, oxygenation, pretreatment)
  2. Sedation (ketamine, etomidate, versed, propofol)
  3. Paralytic (succinylcholine, rocuronium, vecuronium)
MCC: Referring Facility

- 1854: 103 – 157/133
- 1855: 104 – 48/23
- 1859: O-neg PRBCs (#1) infusing
- 1900: 96 – 89/59
- 1904: TXA bolus
- 1911: NS (#3) started
- 1915: 103 – 18 – 98/55
TXA: Tranexamic Acid

- Synthetic derivative of the amino acid lysine – inhibits fibrin degradation → **Stabilizes clot formation**
- Used in managing significant hemorrhage in the trauma patient, especially in those requiring multiple transfusion of blood products.
- Inclusion/exclusion criteria
- Bolus dose given - followed by maintenance infusion over 8 hrs
MCC: Referring Facility

- 1920: PRBCs (#2) started
- 1923: NS (#4) started  97.7 – 96 – 12 – 102/66
- 1928: Posterior exam – backboard removed
- 1930: Pressure dressing to leg
- 1934: FFP (#1)
- 1936: NS (#5), FAST exam  96 – 78/54
- 1938: PRBCs (#3)
FAST Ultrasound

**FAST**

- Focused assessment with sonography for trauma - free fluid in abd

- 5 areas of focus:
  - Perihepatic
  - Perisplenic
  - Pelvic (bilateral)
  - Pericardial
Careflight (1948 – 2112)


- 1959: To ambulance

- 2002: 72/33

- 2005: PRBCs (#4)
Careflight (1948 – 2112)

- 2006: Pt moving – ketamine given
- 2015: Pt loaded into fixed wing 81/45 - 104
- 2030: PRBCs (#5) started 78/51
- 2035: Ketamine & Fentanyl
- 2050: PRBCs (#6 & 7) 91/44 - 102
- 2102: Land in SF
- 2112: McK ED – Level I Trauma Team, Massive Transfusion Protocol Activated
Level I Trauma Team Activation Criteria

Physiological Parameters:
- SBP < 90 mmHg at any time in adults & children > 10 years
  - Age specific hypotension in children:
    - SBP = 70 + 2X age in years
    - Additional pediatric clinical criteria for consideration:
      - Level of consciousness
      - Peripheral pulse - quality, character
      - Skin perfusion
- Respiratory rate < 10 or > 29
- Heart Rate > 120
- Glasgow Coma Scale < 10 with Mechanism Attributed to Trauma

Anatomic Parameters
- Respiratory Compromise/Obstruction ~ **ANY** Intubated Patient
- Hangings & Drownings with Airway Compromise require Level I Trauma Team Activation with Admit to Trauma as Primary
- Penetrating Trauma to the Head, Neck, Torso
  (Chest, Abdomen, Posterior Surfaces) or Groin
- Transfer Patients Receiving Blood to Maintain Vital Signs
- Unstable Pelvic Fracture
- Flail Chest
- Spinal Injury with Paralysis &/or Neurological Deficits
- Burns > 20% or involving Face or Airway
- Amputation Proximal to Wrist or Ankle
- Two or More Proximal Long Bone Fractures (Humerus, Femur)
- Emergency Medicine Physician Discretion
McKannan Massive Transfusion Protocol

- Hemodynamic instability and/or $\geq 6$ units PRBCs within four hours
- Pt requires the need to replace 50% of blood volume within 2-3 hrs

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<th>MTP Pack #1</th>
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<tr>
<td>PRBC- 6 units</td>
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Coagulopathy & IV Fluids

- Analysis using the German Trauma Registry Database: 8,724 patients

  - Coagulopathy present in 34.2% of ALL trauma patients

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<th>IV Fluid Amount</th>
<th>Incidence of Coagulopathy</th>
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<td>&lt;500 cc</td>
<td>10%</td>
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<td>&gt;2000 cc</td>
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<tr>
<td>&gt;4000 cc</td>
<td>&gt;70%</td>
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Coagulation defined by PTT < 70% and/or platelets < 100,000

Injury (2007).
MCC: McKennan

  - L)leg drsg blood soaked, + femoral pulses
- 2129: PRBCs (#8 & 9), NS (#6) started on rapid infuser
- 2130: Portable chest x-ray
- 2132: FAST exam
- 2135: Femoral artline placed
- 2142: Pt moving – fentanyl & versed
MCC: McKennan

  - L)leg drsg blood soaked, + femoral pulses
- 2129: Portable chest x-ray, PRBCs (#8 & 9), NS (#6) started on rapid infuser
- 2132: FAST exam
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MCC: McKennan

- 2144: L)leg examined – tourniquet not tight: re-dressed & tourniquet tightened
- 2150: PRBCs (#10 & 11) 93/77 96
- 2154: NS (#7)
- 2159: FFP (#4) – bleeding now controlled
- 2200: FFP (#5) – x-ray to L)leg
- 2214: To CT 131/87 102
  - Fentanyl & versed in CT
Identified Injuries

- R) eye lac
- Abrasions
- L)pneumothorax
- L) rib fx’s 1-9 with flail
- R) rib fx’s multiple
- Bilateral pulmonary contusions

- L)lower extremity compound open fx
- R)orbit fx
- T4-T7 spinous process fxs
- L)mandible fx
- L)AC joint separation
- PMH: Hepatitis C

ISS: 29
Ps: 0.274
MCC: McKennan

- PTD #0-1: (ICU)
  - L) Chest tube placed
  - Central line placed
  - 0020: To OR
    - L) traumatic above the knee amputation with wound vac placement
    - PRBCs (#12 & 13)
  - Facial laceration repair
Central Line (triple lumen)

Trauma Cortis
Or
“Introducer”
MCC: McKennan

- PTD #2-6
  - Remains intubated, VSS
  - PTD #3: Return to OR – I & D L)stump
  - PTD #4: Extubated, L)chest tube removed
  - PTD #5: Respiratory distress- tx to ICU & re-intubated, L)chest tube placed
  - PTD #6: Extubated
- PTD #8: Tx to floor
- PTD #16: Tx to Rehab
MCC: McKennan

Performance Improvement

Anything that we could do differently to improve care?
Case Study #2

Fall

60 y/o male fell 20 feet landing on buttocks. 10 sec LOC. Pt was on a ladder in a tractor bucket.

51 y/o male who slipped and fell on his icy driveway and striking the back of his head.

84 y/o male was ambulating from the bathroom, tripped and fell striking his left side against the bedpost.

82 y/o male un-witnessed ground level fall outside

80 y/o female feet tangled in O2 tubing and fell backwards landing on head (On coumadin)
### Definition of a Trauma Team Alert patient:

**South Dakota Trauma System**

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Fall

- 51 y/o male who slipped and fell on his icy driveway, striking the back of his head.
  - Positive LOC – 20 minutes
- Referring Facility (1232 – 1523)
    - GCS 14
  - 1242: IV started, warm blankets
  - 1248: Head CT
Fall

- Referring Facility (1232 – 1523)
  - 1328: Return from CT – nauseated
  - 1343: 106 – 18 – 100% on non-rebreather
    - Restless, trying to sit up in bed - ativan
  - 1415: Transport @ beside
  - 1500: RSI
  - 1523: To McKennan
Fall

- Ground Transport (1415 – 1800)
  - 1520: 94.0 - 16 - 119/58 - 99 - 95% via vent - GCS 3
  - Fentanyl, propofol, ativan, vecuronium PRN
  - 1712: 149/82 – 15 - 107
What was the cause of this patient’s hypothermia?
Causes

On scene
- Environment
- Extrication
- Entrapment
- Exposure

During transport
- Environment
- Exposure
- Anaesthesia/sedation
- Fluids

Admission / work-up
- Environment
- Exposure
- Anaesthesia/sedation
- Fluids
- Transfusions

Surgery / intervention
- Environment
- Exposure
- Anaesthesia/sedation
- Fluids
- Cavity exposure

Ongoing bleeding and shock
- Exposure
- i.v. fluids
- Medications (sedation/anesthesia)

Soreide (2014).
Pitfalls in the Trauma Bay

- Not checking/documenting a temperature
- Not warming IV fluids and/or blood products
- Over-exposure

Gerecht (2014).
Hypothermia

Gerecht (2014).

Cardiovascular

- Decreased cardiac output and myocardial ischemia
- Decreased cardiovascular response to catecholamines (epinephrine)
- Impaired tissue oxygen delivery
- Arrhythmias such as atrial fibrillation and v fib

Infection

- Decreased number and function of white blood cells
- Increased risk of wound infection, pneumonia and sepsis

Bleeding

- Decreased function of coagulation factors and platelets to make clot and thus stop hemorrhage
Trauma’s Lethal Triad

Coagulopathy

Hypothermia

Halt coagulation cascade

Lactic acidosis

Decreased myocardial performance

Metabolic Acidosis
Lethal Triad & Other Aspects

Diagram showing the relationships between trauma, hemorrhage, resuscitation, shock, coagulopathy, and other factors such as inflammation, other diseases, medications, genetics, dilution, acidemia, hypothermia, fibrinolysis, and factor consumption.

Fall

- Avera ER (1813-1920)
  - Level I Activation
  - Restless, combative and biting tube. Propofol gtt re-initiated
  - 1820: 101.4 – 104 – 183/126 – 20 – 97% on ventilator
  - 1830: FAST exam
  - 1857: CT scan
  - 1920: Transfer to ICU
Fall

Injuries:
- Lt. temporal skull base fracture and adjacent occipital calvarium fracture with trace pneumocephalus
- IVH
- SDH
- Countercoup parenchymal contusions
- Pulmonary Contusion
- L) rib fx 5-7

Co-Morbidities:
- HTN
- GERD
- OSA

ISS: 19
Ps: 0.986
Fall

- PTD #0
  - EVD / ICP placed at bedside
  - No SCD’s or chemical prophylaxis
- PTD #2
  - Extubated
  - MAE appropriately, follows commands
- PTD #4
  - Transfer to Neuro Acute
Adapted from Kerr and Crago, with permission from Elsevier.
Fall

- PTD #0
  - EVD / ICP placed at bedside
  - No SCD’s or chemical prophylaxis
- PTD #2
  - Extubated
  - MAE appropriately, follows commands
- PTD #4
  - Transfer to Neuro Acute
Fall

- PTD #9
  - Scheduled to move to Avera Rehab. Acute onset of SOB: increased HR / BP, increased O2 demands with a temp of 103.0
  - CT chest: bilateral PE’s, dopplers (+) for bilateral DVT’s, Heparin gtt started
  - Transfer to ICU
  - No SCD’s or anticoagulation since admission
Fall

- PTD #10
  - IVC placement
- PTD #12
  - Transfer to Neuro / Lovenox started
- PTD #14
  - Internal Medicine is now primary
Fall

- PTD #15
  - Coumadin started
- PTD #21
  - Discharged to McKennan Rehab
  - Coumadin / Lovenox
Fall

Performance Improvement

Anything that we could do differently to improve care?
Case Study #3
MCC
MCC

- **0558**: EMS dispatched

- 50 y/o male. “EMS called to scene for a patient who had an apparent allergic reaction”. Found in ditch sitting up next to motorcycle (handlebars bent & windshield broken).

  - Pt called family member around 0500. Family went looking and found pt then called EMS @ 0558.
MCC: EMS

- 0604: At scene
  - Facial swelling
  - Purple nipple line & up
  - Difficulty breathing
  - Abrasions to R)side & front
  - Pt states he “blacked out” & allergy to bee stings
- GCS 15 - HR 114 – RR 30
0606: Called for ALS intercept
0614: En route to hospital
0615: Epi given, O2 NRB applied
0623: ALS intercept
  210/145 – 24 – 124 – GCS 15
  c/o shortness of breath, speaks in short bursts
  Attempts to sit up and remove mask
  Abrasion noted to L)arm and small red mark on back
MCC: EMS

- 0625: IV established
- 0628: Benadryl IVP
- 0645: At referring facility
MCC: Referring Facility

- 0649: 98.2 – 123 – 24 – 100% NRB – 192/107 - GCS 12
  - Pt restless, sub-q emphysema from head to top of legs, stridor
- 0700: C-collar applied
- 0705: Chest x-ray obtained
- 0715: To CT scan
MCC: Injuries

- Pneumothorax L > R
- Hemothorax
- Pulmonary contusion RLL
- R) Rib fx 1-9
- Mediastinal hematoma
- L) Fibula fx
- AC separation – grade 4

ISS: 13
Ps: 0.9641
MCC: Referring Facility

- 0740: Return from CT
- 0750: 126 – 25 – 194/116 – 100% NRB
- 0755: RSI
- 0800: Bilateral chest tubes placed
MCC: Careflight

- **0810**: Intubated, bilateral chest tubes in place
  - Sub-q emphysema head to toes
  - Abrasion to anterior neck, R)shoulder, upper mid abdomen, R)flank & L)foot
- **0828**: Lift for Sioux Falls
  - VSS, receiving sedation, pain rx
- **0902**: Level I Trauma Team @ McKennan
MCC: McKennan

- PTD #1: Pt extubated
- PTD #2: Epidural placed
- PTD #5: Pain with ambulation, x-ray taken (fibula fx)
- PTD #8: Retained hemothorax
- PTD #10: To OR: Thoracotomy with rib fixation and evaluation of hematoma
MCC: McKennan

- PTD #15: Retained hemothorax con’t. IR placed chest tube
- PTD #20: Chest tube con’t. to have drainage. O2 demands decreased.
- PTD #22: Chest tube removed. Pt on room air
- PTD #23: Discharge to rehab on room air, ambulating
Things are not always what they seem...
MCC: McKennan

Performance Improvement

Anything that we could do differently to improve care?
Pitfalls

- Temperature / Respiratory rate monitoring
- Getting patients undressed > FULL assessment
- IV fluid administration
- Ratio based resuscitation
- Activation > undertriage
- Charting
  - EMS reports > please send a copy!
Questions??
erin.beck@avera.org
References